REMARKS

Claims 1, 12 and 21 are pending. Claims 22-27 have been withdrawn as being drawn to a non-elected species. Claim 1 is amended, incorporating the subject matter disclosed throughout the specification and including, *e.g.,* p. 7, lines 17-19 of the specification. No new matter is added. Favorable consideration of the currently pending claims is respectfully requested in light of the foregoing amendments and following remarks.

Rejection Under 35 U.S.C. § 112

In the Office Action, the Examiner rejected Claims 12 and 21 as indefinite under 35 U.S.C. § 112, second paragraph. As suggested by the Examiner, applicants have amended Claim 1 to clarify that "a reactive epoxy containing coating having epoxy groups occurs on a surface of the substrate." Applicants thus believe that the limitations of Claims 12 and 21 now have proper antecedent basis and request that the rejection of these claims under 35 U.S.C. § 112, second paragraph, be withdrawn.

Rejections Under 35 U.S.C. § 103:

In the Office Action, the Examiner rejected the then-pending claims under 35 U.S.C. § 103(a) as unpatentable over Connell *et al.* (UK 1,037,144) ("Connell") in view of Timmons *et al.* (5,876,753) ("Timmons") or vice versa. In addition, the Examiner rejected the claims under 35 U.S.C. § 103(a) as unpatentable over Timmons in view of Kolluri *et al.* (5,723,219) ("Kolluri"), and Timmons in view of Chabrecek *et al.* (WO 98/28026) ("Chabrecek"). Applicants respectfully submit that the arguments presented below overcome the Examiner's rejection.

All of the rejections in the Office Action rely on rely upon Timmons' disclosure of plasma polymerization of monomers using a pulsed plasma discharge. To summarize the core issues relating to Timmons, the Examiner alleges that (1) comparison between the claimed plasma discharge powers and of those taught in Timmons is not

possible, and that (2) the use of the claimed plasma discharge powers results from routine experimentation from the teachings of Timmons. Applicants respectfully traverse.

As to the first point, that comparison between the claimed plasma discharge power cannot be made to the powers disclosed in Timmons, applicants submit the Declaration by Dr. Stephen Coulson herewith (referred to herein as the "Declaration."), who was involved in the research related to the subject matter claimed in the present application. Dr. Coulson states the following with respect to the comparison of Timmons' data with that of the present application:

> The Examiner has identified that it is difficult to make true comparisons between the pulsed plasma polymerization conditions that characterize the claimed method and those conditions which are disclosed in Timmons. Whereas we have used as the defining parameter the average power **density**, Timmons' data is in the form of average powers. Moreover, because Timmons does not state the volume of the chamber in which the average power is applied, the plasma density cannot be calculated; therefore direct comparison of power densities is not possible. The Examiner has also pointed out that the experimental data in the present application refers only to peak powers for the generation of the plasma. However, the Examiner has herself used a formula that is provided in Timmons for deriving average powers on the basis of given peak power data. The use of this formula will allow proper comparisons to be made between Timmons and the claimed method.
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> By the use of the Timmons formula, the Examiner has been able to derive average power data from the Timmons patent and states on page 6 lines 3-5 of the Office Action of August 13, 2008 that "average powers for exemplary duty cycles [in Timmons] would be approximately 75W, 33W, 12.5W & 0.095W respectively, but are for total power output, not power density, thus cannot be directly compared to the claimed parameter range" [viz. an average power density of not more than $0.0025W/cm^3$]. It is noted that the final number provided by the Examiner is believed to be incorrect and should instead be **9.5W** (*i.e.,* 3/63 x 200W).
>
> Although the chamber volume used is not listed in the present patent specification, I can confirm that it was $470cm^3$. Consequently, the claimed range for the average power density parameter of less than $0.0025W/cm^3$ equates to a maximum average power of 470 x 0.0025 = 1.175W. Or, on a like-for-like basis, the maximum possible power used in the process described

> in the present application is **almost an order of magnitude less** than the lowest value for this parameter that can be derived from Timmons.
>
> The examples that are set out in the present patent application underline further the substantial differences between the respective processes. In the examples, a peak power of 40W is used, with a time "on" of 20μs and a time "off" of 20ms. Using the formula given in Timmons, this means that the average power was just under 0.04W which is **more than 200 times less than any average power referred to in Timmons.**

(Declaration, paras. 3-6). In view of the above, applicants submit that a proper comparison of the claimed plasma discharge powers to those of Timmons can be made, and this comparison shows that the lowest powers described in Timmons (accounting for the assumed calculation error in the Office Action) are almost an order of magnitude higher than the claimed average power density of 0.0025 W/cm^3. Moreover, the average powers described in the examples of the present application are more than 200 times less than those referred to in Timmons. Timmons thus does not disclose at least the limitation of Claim 1 that the "average power density of the pulsed plasma discharge is less than 0.0025 W/cm^3.

To address the issue of "routine experimentation," experiments were conducted with glycidyl methacrylate as follows:

> Further experiments have now been conducted with glycidyl methacrylate (GMA) which demonstrate that it is **only at extremely low power densities, combined with a specific choice of a monomer containing a functional group that will polymerize easily,** that full retention of the epoxy functionality is achieved. This is important for maximizing the subsequent reactions for achieving the best possible performance of the resulting product. Two plasma polymerizations were carried out at respective average power densities of 0.0025 and 0.00025W/cm^3 with the following analytical data for the polymer product obtained by XPS:

Carbon Environment	Theoretical (%)	Power density 0.00025W/cm^3 (%)	Power density 0.0025W/cm^3 (%)
Epoxide	28.6	25.01	18.35

These results show that **just outside the claimed limit of average power density of 0.0025W/cm^3 there is observed a substantial falling off in the percentage of the epoxide functionality of GMA that is retained in the plasma polymer obtained,** especially when viewed in the light that a practically realizable maximum epoxide content for polymerized GMA is in fact most likely to be somewhat lower than the theoretical figure. By dropping below the claimed limit of power density in accordance with the claims of the present application, it is clear that far better structural retention results, which is the desirable outcome.

The Examiner asserts that the establishment of our reaction conditions was merely a matter of "routine experimentation to provide an effectively low power plasma as taught by Timmons *et al.* to enable retention of active functional groups." However, while Timmons certainly refers to the use of "low" powers, the patent does not define how such "low powers" are to be judged, and all of the evidence in the Timmons patent specification points towards average powers (in W) for the polymerization process which are of the order of no lower than single figures (*e.g.,* 9.5W as discussed above). In my opinion, the reaction conditions of the present application are completely remote from anything that was contemplated by Timmons *et al.* and well outside of the scope of "reasonable experimentation" based on the evidence in the Timmons patent. It also requires a judicious choice of starting chemical with a particular polyermizable group.

In my view the Office Action does not explain how Timmons can be read as teaching the use of the presently claimed very low average powers and the specific choice of a monomer containing a functional group that will polymerize easily. In my opinion **is it not a simple matter of routine experimentation** to determine that such very low powers were necessary in order to achieve the desired functional retention as demonstrated by the applicants of the present application in producing a plasma polymer from GMA.

Here it is also appropriate to point out that Timmons did not address the use of GMA monomer as the feedstock for his process, consequently the teachings of Timmons are not necessarily a useful guide to how GMA can best be processed to obtain a polymer with high retention of the epoxy functional group. Indeed, some experiments were performed by the applicants of the present application (reported as Examples 4 and 5 in the present patent application) which are very suggestive of the fact that Timmons is not at all a useful guide on this point.

(Declaration, paras. 7-10). In view of the data and analysis presented by Dr. Coulson above, applicants respectfully submit that it would not be a matter of routine experimentation to utilize the claimed average power density of the pulsed plasma discharge. Moreover, Dr. Coulson explains that it is not merely the use of low powers in the claimed method that results in the reactive epoxy coating, but also the "selective choice of a monomer containing a functional group that will polymerize easily." The claimed method utilizing GMA as the monomer and an average power density of pulsed plasma discharge less than 0.0025 W/cm^3 is neither disclosed nor suggested in Timmons or the other cited references.

Dr. Coulson also describes in his Declaration (paras. 11-12) the deficiencies of the epoxy-containing material described in Timmons (AGE) when treated under the conditions described in the present application. Finally, Dr. Coulson recognizes the lack of illustrative examples in Kolluri and Connell (para. 13), neither of which discloses the claimed average power density of pulsed plasma discharge. Moreover, Connell lacks true relevance to presently claimed methods as it is entirely limited to disclosure of a continuous wave polymerization process.

In view of the above, applicants thus submit that Timmons does not disclose or suggest a method for applying a reactive epoxy containing coating to a substrate by subjecting the substrate to a pulsed plasma discharge in the presence of GMA, "wherein the pulsed plasma discharge is achieved by applying a power pulse to the plasma, and wherein an average power density of the pulsed plasma discharge is less than 0.0025 W/cm^3." Moreover, the claimed average power density if the pulsed plasma discharge is not the result of routine experimentation of the methods described in Timmons.

The other references cited in the Office Action fail to cure the deficiencies of Timmons noted above. Applicants thus submit that Claim 1, as amended, is patentable over the cited references, and applicants respectfully request that the rejections of Claim 1 under 35 U.S.C. § 103 be withdrawn.

Claims 12 and 21 are dependent on Claim 1 and incorporate all of its limitations. As applicants believe that Claim 1 is allowable, Claims 12 and 21 are also believed to be allowable.

CONCLUSION

Based upon the amendments and remarks provided above, applicants believe that Claims 1, 12 and 21 are in condition for allowance. A Notice of Allowance is therefore respectfully solicited.

No additional fees are believed due; however, the Commissioner is hereby authorized to charge any additional fees that may be required, or credit any overpayment, to Deposit Account No. 11-0855.

If the Examiner believes any informalities remain in the application that may be corrected by Examiner's Amendment, or there are any other issues that can be resolved by telephone interview, a telephone call to the undersigned attorney at (404) 815-6500 is respectfully solicited.

Respectfully submitted,

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